

(about one in ten being *v. obscura*) and two females were obtained. This insect is certainly the most beautiful form of *H. arethusa*.

H. arethusa v. galatia (Zapt.):—Albarracin; a small form rather darker than the Provence race. Locally common in the Val de Vecar and on the road to, and at Losilla, females just emerging August 4th.
(*To be concluded.*)

The Asiatic origins of the Western Palaearctic Rhopalocera exemplified by *Melitaea didyma*, Esp.

By ROGER VERITY, M.D.

Several writers have of late already deplored the unfortunate way in which Staudinger has erected names for some European variations of this species, basing them on a few words of description, which apply equally well to many forms in reality perfectly distinct from each other by characters he failed to grasp, because they evidently were beyond the spirit and knowledge of his times. His confused state of mind in this respect is shown by the way he shifted the references from one name to the other in the three editions of his *Catalog*. It seems to me, however, that, if one takes the trouble to do so, one can very well restrict the meaning of his names and define them in such a way that they can be worked into the present knowledge we have acquired on this subject. I have been striving for some time to collect the necessary materials and I believe I now have before my mind a tolerably good picture of the distribution of the various races in Western Europe, so that the time has come to attempt a rational classification and to draw a few general conclusions of some interest. If other Palaearctic species had not afforded a much clearer view of their lines of migration and of the exerges, which have been produced in the various regions they have reached, it would no doubt have been difficult to get an idea of them from *didyma*, but now, we know something about them, the facts one observes in it evidently indicate that its behaviour in the past has been in accordance with the general rules and similar to that of other *Melitaeae*. One can, in consequence, deal with it by grouping its races under the heading of, more or less, the same exerges, but one must bear in mind that these are very probably much less highly differentiated than, for instance, the corresponding ones of *M. aurinia*, on account of the far greater organic elasticity of *didyma*, enabling it to adapt itself individually to extremely different surroundings so that it has not had to split into groups with widely different constitutions, each suited to particular conditions. This is proved by the much greater differences in the morphological features of the spring and of the summer emergences of some races, than in those of the races when compared with each other. For the same reason it has never thrown out a local satellite species after its arrival in the extreme west, like *aurinia*, *phoebe* and *athalia* have done under the stress of heat, drought and parched food. As a matter of fact, *M. didyma* and more particularly *trivia* and *saxatilis*, not to speak of *acraeina*, which is culminating in this sense, have no doubt, been evolved especially to stand conditions of this sort, as well as a very variable climate, because they have originated in Asia, later than the rest of the genus. One can trace back the evolution of the *Melitaeae* in a satisfactory way as having

arisen from the American tropical and sub-tropical genus *Phyciodes*, some species of which pushed northward into a temperate climate, like they are still doing at the present day, and transformed their constitutions accordingly. Some *Phyciodes* of North America obviously exhibit chiefly, on the upperside, the features of the various groups of *Melitaea* and strongly suggest that each of the latter may have evolved from a different one of the former, except in the case of the *didyma* group, which has, as far as I can make out, no representative in America and no *Phyciodes* recalling either its general aspect or its characteristic feature. This I take to be the reduction on the underside, to internervular dots, of the crescent-shaped premarginal streak of the other *Melitaeae*. It is noteworthy that this characteristic is in no way a new development, but, to a certain extent, a return to a sort of marking familiar to us in the *Lycaenidae*, and present in several *Erycinidae*, although in the latter families the premarginal dots have a different origin and correspond to the black dots in the orange band of *cinxia*, whilst in *didyma* they are produced by a more external part of the pattern which has been developed by the *Nymphalidae*. I think one can safely maintain that the *didyma* group, including *trivia*, *saxatilis*, *acraeina* and probably *romanori*, have been wholly produced as a result of the influence of Asiatic surroundings. Seitz, in his *Fauna Americana*, p. 434, states that the underside of *M. minuta*, Edw., is so similar to a small *didyma*, one must consider it its American representative. This I cannot agree with at all. It corresponds, if anything, to *arduinna*, Esp., and it still stands very close to *cinxia*, L., by the shape of the wings, the general pattern and the black dots in the orange band of the hindwings. In the high mountains of Western China, instead, there really exists the species (*agar*, Obth.), which is a perfect transition from *minuta* to the *didyma* group and which already distinctly belongs to the latter by the shape of the wings and the general pattern, including the internervular premarginal dots, although the underside still recalls *minuta* and retains its dots in the orange band. The process of variation, which has produced the *didyma* group, did not, however, stop at this grade of transformation of the transverse bands into rows of spots: in *M. yuenty*, Obth., it is carried further and it culminates in the remarkable Chinese genus *Timelaea* with a leopard-like spotting on the whole of both surfaces.

As this line of variation is entirely absent from America we can presume there were no *didyma*-like species in the great Arctic continent, with a temperate climate, where we believe the genus *Melitaea* originated, together with most of the other principal Holarctic genera, during the Secondary Ages, when Siberia and Alaska were tropical, and we can presume that the *didyma* group originated from the Asiatic portion of the *cinxia* group, after it was driven southward by the onset of the cold period of the end of the Cretaceous and of the beginning of the Eocene. The Lepidoptera certainly sustain admirably this "north Polar theory" of Wallace and the facts one observes in the distribution of the Holarctic genera all over the world compel one to believe in a vast migration, which carried some of them even across the equator, along the tops of the mountain chains which stretch from north to south, as far as Patagonia and New Zealand and, under more modified forms, probably also South Africa. The lines of this migration, which included *didyma* and its nearest allies, are the west-

ward ones from Eastern Asia. The origin and the distribution at the present day of most Palaearctic species is due to them and to their having been split into several lines and stopped at intervals, during long periods of time, in various regions by a chain of inland seas, which separated Siberia from the great Pamiro-Thibetan island, Russia from Anterior Asia, Central Europe from the Balkans and Western Europe from Africa.

Some time after the marked change of climate at the end of the Cretaceous had transferred the flora and fauna of the Arctic continent into Eastern Asia, an isthmus joined the eastern end of the Pamiro-Thibetan island to western China and chains of islands emerged from the Han-Hai sea, which covered most of the Eastern Turkestan and of Thibet, stretching across that sea from east to west, as shown by the mountains they have turned into at the present day. The species, which had been stopped in the south-west of China by too hot a climate further south, availed themselves of this outlet and spread westward. Their numbers must already have been considerably increased at that time by their new surroundings in China, as compared with their ancestors, which had come down through Siberia, and since then those that remained in China have obviously multiplied and transformed to an extraordinary extent, producing even many local genera. The lot, which had invaded the Pamiro-Thibetan island, found itself trapped to the north by the Han-Hai sea and to the west by the Aralo-Caspian, which was continuous with the Indian Ocean and with the Arctic ocean, and which was connected to the Han-Hai by two broad arms: the Ferghana-Kashgar and the Dzungarian, with the Thian-shan, as an island, between them. I insist particularly on these geographical points, because it seems to me one can trace back to them the origin of many variations of the Lepidoptera even in Europe. The uplift of the land, which connected Thibet to China, also produced a chain of islands between the Thian-shan and the latter, still existing now as mountains separating the Eastern Turkestan from the Gobi desert. The impulse to a westward migration soon populated the Thian-shan this way from about the same stock as the Pamiro-Thibetan island and created a condition similar to that we can see in the Malay Archipelago, of closely allied, but different, species and exerges in each of those two large islands. This important observation has been made on the spot by Groum-Grshimailo. A third centre of different species and exerges originated on the continent, north of the Dzungarian channel from the migrations, which took place from the N.-E. of Siberia towards the S.-W. and which were compelled to stop along the shores of the Han-Hai and of the Aralo-Caspian seas; the soft maritime climate they found there has apparently been sufficient to save them through the coldest period, but they never have developed into such numerous and differentiated species as their companions, which reached further south by the longer routes, through China. This geographical state of things remained more or less unaltered from the end of the Eocene to the beginning of the Miocene, *i.e.*, close on one million of years, during which the prevalent climate was tropical again, so that most of the species of northern origin must have been obliged to break up into groups in seeking refuge in the various mountain chains, which were then gradually developing their present huge and lofty masses. It is not

to be wondered at that in similar conditions and during such a long period of time a large number of species and even some genera, with striking features, should have come into being in those regions, so that the naturalists of last century credited the legend that the Pamir had been the cradle of humanity and of the greater part of animals and plants. Groum Grshimailo has striven to prove it by the Lepidoptera, in the vol. IV of Romanoff's *Mémoires* (1888), and he has personally made many very interesting observations, but, in reading through his work, it is instructive to note that the facts which puzzled him and which he tried to explain by complicated theories are those which simply suggest the arrival of an original stock to the Pamir and to North America from a common source, such as the arctic one of Wallace's North Polar theory. Groum's efforts to establish his *marcopolo* of the Pamir as the ancestor of all the American *Colias* are quite childish, considering the obvious and enlightening examples this genus affords of the gradual development and radiation of gaudy species in Asia and in America from the arctic *pelidne* and *nastes*, so that *marcopolo* can only be a descendant of *pelidne*, parallel to *palaeno* and representative of the latter in Central Asia. One sees one can never be too careful in attempting to establish the locality of origin of a genus, when one considers such cases as the *Baltia*, which live at great altitudes, where one might have thought they must have originated, whereas, on the contrary, one finds there exist exact representatives of both its species at similar altitudes in the Andes, so that one can only conclude, reasonably, they have travelled an enormous distance from their place of origin in the Arctic continent and they are amongst the oldest and most stable Holarctic butterflies in existence.

(To be continued.)

The caterpillar and pupa of *Opsiphanes invirae* sub-sp. *amplificatus*, Stich.

By KENNETH J. HAYWARD, F.E.S., F.R.G.S.

Larva.—A bright green slug-like larva 60mm. in length including the anal horns.

A squarish head approximately $6\frac{1}{2}$ mm. long by 5mm. in width and about 2mm. thick, clothed posteriorly above the face with short greyish hairs pointing forwards, and at either forward corner two or three larger longer blackish setae. The head behind with four reddish horns projecting backwards, the dorsal pair 1mm. long with a black dot on the inner base of each, the outer pair half the size. In colour the head is green suffused with reddish, four darker lines running from the four anterior horns to frons.

Body pea green covered with minute greenish white specks, the alimentary channel showing dark green with a thin purple line, a pair of parallel, slightly darker, green lines on either side and on the thoracic segments a thick, broken, purple-brown line level with the spiracles which appear on it yellow. Immediately below the dark stripe light yellowish white and beneath greenish to greenish-white. Two horns projecting straight backwards from the anal segment in colour slightly more yellowish green than the remainder of the body. Forelegs tipped chocolate, the spiracle on the first segment orange-red. Found